FOOD AND FEEDING HABITS OF JUVENILE GREATER AMBERJACK, *SERIOLA DUMERILI* (OSTEICHTHYES, CARANGIDAE) IN INSHORE WATERS OF THE CENTRAL MEDITERRANEAN SEA

by

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ABSTRACT. - The food and feeding habits of 168 juvenile greater amberjack (*Seriola dumerili*) were investigated. Small specimens (9.0-18.5 cm standard length) had a planktonic diet, based on decapod larvae, pelagic amphipods and gastropods, while larger ones (20.0-33.0 cm SL) had an essentially piscivorous diet. Such a diet shift seems to be related to the habitat change the fish undergo at a size of about 20 cm, when they abandon offshore waters to come closer to the coast in shallow waters.

RÉSUMÉ. - L'alimentation de 168 jeunes sérioles (*Seriola dumerili*) a été étudiée. Les exemplaires les plus petits (9,0-18,5 cm de longueur standard) avaient un régime planctonique à base de larves de décapodes, d'amphipodes et de gastéropodes pélagiques, tandis que les plus gros (20,0-33,0 cm LS) avaient un régime essentiellement piscivore. Un tel changement dans le régime alimentaire pourrait être mis en relation avec un changement d'habitat qui s'effectue lorsque les poissons atteignent environ 20 cm. A partir de cette taille ils abandonnent le large pour se rapprocher des côtes.

Key-words. - Carangidae, *Seriola dumerili*, MED, Juveniles, Diet.

The greater amberjack, *Seriola dumerili* (Risso, 1810), is a large-sized fish attaining a length of up to 200 cm and weighing 50 kg (Tortonese, 1975). It is widespread in temperate and sub-tropical waters both in the Atlantic and the Indo-Pacific oceans (Smith-Vaniz, 1986). In the Mediterranean sea this species is commercially exploited by purse-seiners. Both immature and adult specimens are commercially important in Italy. Because of this and its potential for rapid growth (Cavaliere *et al.*, 1989; Andaloro *et al.*, 1992) it has been the subject of rearing experiments in concrete ponds (Lazzari and Barbera, 1989a) and floating cages (Giovanardi *et al.*, 1984; Porrello *et al.*, 1993; Andaloro, unpubl. data), with encouraging results (Greco *et al.*, 1993).

Very little is known on the ecology and life history of *S. dumerili*. Mazzola *et al.* (1993) dealt with the diet of juveniles, whilst Lazzari and Barbera (1989b) have made a brief study of the diet of the adults.

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MATERIALS AND METHODS

A total of 168 young specimens of *Seriola dumerili* were caught in summer 1992 near Capo d'Orlando, along the north-eastern coast of Sicily (Fig. 1). Since in the study area greater amberjack undergo marked changes in their spatial distribution according to body size, samples were collected in different areas using different fishing gears. A sample of 36 fishes ranging from 9.0-18.5 cm standard length (SL) were caught between 8.00h and 11.00h during mid-August, at a distance of about 3 nautical miles off the coastline. They were captured with a surface trolling line and artificial bait in the proximity of floating objects such as plastic bags or wooden pieces. A sample of 132 specimens ranging from 20.0-33.0 cm SL were caught by a gillnet set from sunset to sunrise half a mile offshore, on a sandy bottom at 15 m depth, during late August to early October.

Stomachs were preserved in 5% buffered formalin, then dissected for content analysis. All prey items were identified to the lowest possible taxonomic level, counted and weighed (wet weight at the nearest mg).

In order to study food preferences of *S. dumerili*, the following alimentary indexes (Hyslop, 1980) were used: frequency of occurrence *F%*, percent number of empty stomachs *V%*, mean number of prey per stomach *mn*; the dietary coefficient *Q* (= % number of prey * % weight of prey, Hureau, 1970) was also computed.

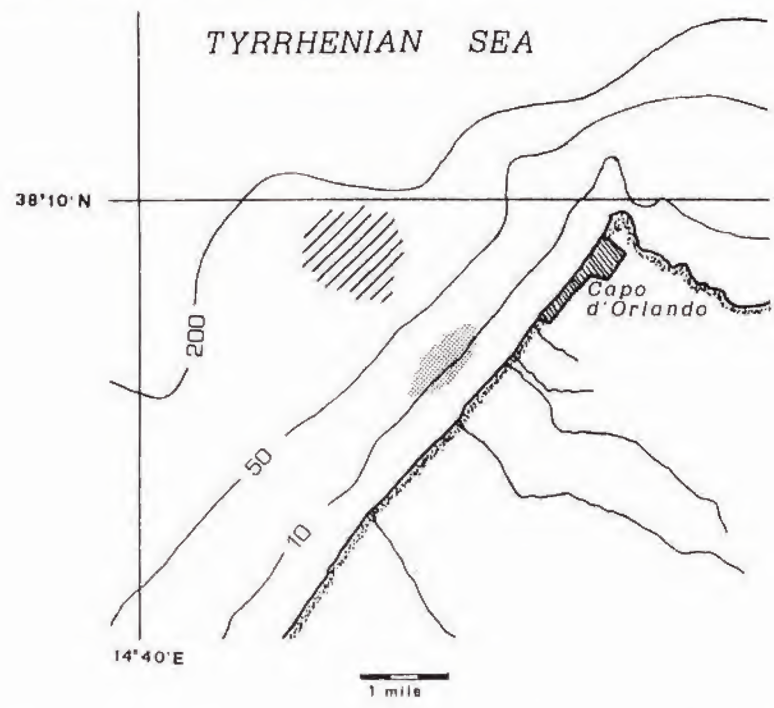

Fig. 1 - Sampling sites of greater amberjack (*Seriola dumerili*) juveniles. . . . . = coastal site. /// = offshore site.

RESULTS

Since the stomach contents analysis suggested clear differences related to fish length, the inshore sample was split into two size-groups. The results of the analysis are summarized in table I.

Group I (36 fishes, 9.0-18.5 cm SL). None of the stomachs in this group was empty (*V%* = 0). Decapod larvae were the most frequent prey (*F%* = 100), with a very high mean number per stomach (*mn* = 85.8). Amphipoda Hyperiidea, Copepoda Calanoida, Stomatopoda larvae, Gastropoda Heteropoda and Mysidacea occurred less frequently. Decapod larvae and calanoid copepods displayed the highest *Q*, followed by amphipods, gastropods and stomatopods.

The total number of prey per stomach was always high (from 36 to over 300). Only in the six smallest specimens (9.25 cm mean SL) copepods were abundant (193 up to 246 specimens per stomach), causing the remarkable *Q* value (Table I).

Group II (114 fishes, 20.0-24.0 cm SL). Of these, 36 stomachs were empty (*V%* = 31.6). Fish were the dominant prey. Other prey items (Isopoda Cirolanidae, Copepoda Calanoida, Euphausiacea and unidentified Malacostraca) contributed little to the diet in terms of *Q*, though isopods occurred in 42.3% of stomachs (Table I). Pieces of dead leaves of seagrass (*Cymodocea nodosa*) occurred in 38.5% of stomachs. In all, 69.2% of the fish had parasitic Trematoda in their stomachs.

Group III (18 fishes, 29.5-33.0 cm SL). All fish in this group (*V%* = 0) had fed upon round sardinella (*Sardinella aurita*). All the stomachs appeared completely full, presenting with distended thin walls. On average the stomachs contained 19 fishes 8-10 cm long. Isopoda Cirolanidae occurred in six fishes.

DISCUSSION AND CONCLUSIONS

As documented for many fish species (Nikolsky, 1963; Wootton, 1991), *Seriola dumerili* undergoes a marked diet shift during development. The method of capture employed, which suited the habits of the fish investigated, did not seem to have any effect on stomach contents. Specimens of group I displayed a strictly planktonic diet based mainly on decapod larvae, pelagic amphipods and gastropods. Organisms such as siphonophores, jellyfish and tunicates were rarely eaten, though they commonly occur in the neritic plankton of the area (Università di Messina, 1985). In deeper habitats this gelatinous fauna has been suggested to have an important role in the diet of other benthopelagic fish species (Gordon and Mauchline, 1990).

On the whole, group I showed the most varied diet. Mazzola *et al.* (1993), studying the same species in northwestern Sicily achieved similar results, although finding that benthic prey might be important in the diet of the smallest specimens.

The presence of demersal sparids (*Pagellus acarne* and *Lithognathus mormyrus*), and of strictly benthic prey (isopods) in fish of group II suggests a diet linked to benthic resources in larger amberjack, although the food spectrum of this group is much less diversified than that of group I. Amberjacks in group III fed quite exclusively upon fish, although pelagic (*Sardinella aurita*) instead of demersal.

Crustaceans often predominate in the diet of larval and juvenile stages of piscivorous fish (Marks and Conover, 1993). The predominance of fish prey in the diet of

Table I. - Stomach contents of greater amberjack (*Seriola dumerili*) juveniles caught near Capo d'Orlando. F% = frequency of occurrence; Q = dietary coefficient; mn = mean number of prey per stomach; N = number of stomachs examined; V% = percent number of empty stomachs. (1) = *Hyperia schizogeneios, Anchylomera blossevillei, Brachyscelus crusculum, Euprimno macropus, Hyperia latissima*, plus unidentified specimens.

	3 miles offshore			1/2 mile offshore					
	(9.0-18.5 cm SL)			(20.0-24.0 cm SL)			(29.5-33.0 cm SL)		
	Group I			Group II			Group III		
Prey items	**F%**	**Q**	**mn**	**F%**	**Q**	**mn**	**F%**	**Q**	**mn**
PHANEROGAMAE									
Cymodocea nodosa	-	-	-	38.5	-	-	-	-	-
CNIDARIA									
Siphonophora	8.3	0.01	1.0	-	-	-	-	-	-
MOLLUSCA									
Gastropoda									
Atlanta peroni	58.3	23.0	12.7	-	-	-	-	-	-
Cephalopoda	8.3	0.002	1.0	-	-	-	-	-	-
CRUSTACEA									
Copepoda Calanoida	66.7	327.6	67.2	7.7	0.02	1.0	-	-	-
Stomatopoda (larvae)	66.7	11.6	4.7	-	-	-	-	-	-
Euphausiacea	25.0	0.03	1.0	3.8	0.02	2.0	-	-	-
Mysidacea	50.0	0.64	2.5	-	-	-	-	-	-
Isopoda									
Cirolanidae	16.7	0.2	11.0	42.3	42.2	3.4	33.3	0.1	1.5
Idoteidae	50.0	0.26	1.3	-	-	-	-	-	-
Sphaeromatidae	16.7	0.001	1.0	-	-	-	-	-	-
Unidentified	16.7	<0.001	2.0	-	-	-	-	-	-
Amphipoda Hyperiidea (1)	75.0	124.2	19.7	-	-	-	-	-	-
Decapoda (larvae)	100.0	2813.7	85.8	-	-	-	-	-	-
Malacostraca (unident.)	16.7	5.2	20.5	3.8	0.02	1.0	-	-	-
OSTEICHTHYES									
Sardinella aurita	-	-	-	-	-	-	100.0	9516.0	9.0
Lithognathus mormyrus	-	-	-	3.8	14.5	1.0	-	-	-
Pagellus acarne	-	-	-	7.7	61.2	1.0	-	-	-
Uranoscopus scaber	8.3	0.1	1.0	-	-	-	-	-	-
Unidentified	16.7	0.1	1.0	84.6	211.5	-	-	-	-
TREMATODA (Parasitic)	-	-	-	69.2	-	-	-	-	-
	N = 36		V% = 0	N = 114		V% = 31.6	N = 18		V% = 0

greater amberjack juveniles seems to start at about 20 cm SL, as observed also by Mazzola *et al.* (1993). Such a diet shift is likely to be related to changes in habitat. Our studies along with information from local fishermen suggest that along the north-eastern Sicilian coast greater amberjack juveniles spend the first weeks of life in offshore waters, where they exploit pelagic resources. Only later they come closer to the coast, where the benthic environment provides a different food supply.

In view of the potential for rapid growth in greater amberjack (up to 50 cm SL and 2.1 kg in age group 1, Andaloro, 1993), knowledge of its natural diet coupled with future studies on food intake and feeding rate might be useful in developing farming techniques.

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